

PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



PLANTERS' BULLETIN THIRTYTWO

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Price
50 Cents



September
1957

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LOCATION. The institute's laboratories and offices at the third mile, Ampang Road, Kuala Lumpur are open from 8 am to 1 pm and 2 pm to 4 pm on Mondays to Fridays, and from 8 am to 12.30 pm on Saturdays.

EXPERIMENT STATION AND FACTORY. This station of the R R I is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur — Kepong — Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement. There is a guest house.

CORRESPONDENCE. ALL LETTERS must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of particular officers. The address for TELEGRAMS is Searching, Kuala Lumpur. TELEPHONE: Kuala Lumpur 3351. PARCELS occasionally arrive without any indication of their origin. Senders' names and addresses should be written clearly on the outside of all packages, and advice of despatch should be given by letter or telegram.

PROHIBITED PLANT SPECIMENS. Attention of planters and others in territories outside the Federation of Malaya and the Colony of Singapore is drawn to the Malayan Plant Importation Rules which prohibit the importation into Malaya of any part of a plant, whether living or dead, unless it is accompanied by a permit issued by the Director of Agriculture, Federation of Malaya. No permit will be issued in respect of any diseased plant or any plant pest. Any plant imported in contravention of these Rules (whose object is to prevent the introduction of diseases or pests) will be destroyed without examination. Anyone outside Malaya who desires our advice on any matter that may require examination of living material must first inquire by letter.

ADVICE. Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. Where it is considered necessary, visits will be made to estates in Malaya as convenient. Visits to estates in other territories are by special arrangement. The only visits for which charges are normally made are those of our clone identification inspectors. INTERVIEWS should be arranged by letter, as members of the senior research and advisory staff are frequently absent on visits to plantations.

PUBLICATIONS. Subscription to all or any of our series of publications (*Planters' Bulletin*, *Journal*, *Reports*, and miscellaneous booklets) may be made by depositing \$15 with us. An annual statement of account will then be submitted. We are unable to give annual subscription rates or any form of discount, but for multiple subscriptions a lower rate of initial deposit is acceptable. Postage is charged on oversea mailings. A list of 'Publications of the RRI' is available on request.

PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur

September 1957

Number 32

Early Rubber Research in Malaya

Rapid expansion has characterised the development of the natural rubber planting industry over the fifty years of its existence. During this time production in S.E. Asia has risen from a mere five hundred to well over one and a half million tons a year, with Malaya and Indonesia as the major producers. The value of total rubber exports from Malaya alone has considerably exceeded two thousand million Malayan dollars per year. World consumption of natural and synthetic rubber is estimated to exceed production for a number of years to come, so that all growers of natural rubber may expect to find buyers in the world markets.

Research on rubber has been in progress for many years, perhaps having its origin when the natives in the jungles of Brazil found that rubber would keep better if dried in the smoke of a wood fire. But compared with the growth of the planting industry, this progress has been slow. Vulcanisation, a most important discovery which opened up many new uses for rubber, was not known as a scientific process until well into the nineteenth century.

The first person to bring a scientifically trained mind to bear on the everyday problems connected with growing the rubber tree and obtaining latex from it was the late Mr H.M. Ridley, who is rightly regarded as the father of the Malayan planting industry. As Director of the Botanic Gardens, Singapore, he was able to devote only part of his twentytwo years in Malaya to rubber problems.

In 1909, the year before Ridley's retirement, a group of leading rubber companies in London were considering the needs of the new industry for a fulltime scientist to advise on production problems. As a result the Rubber Growers' Association appointed a research chemist, Mr Sidney Morgan, to conduct experiments on the curing of rubber. He arrived early in 1910 and established a small laboratory adjoining the factory on Bukit Raja Estate at Klang. Later that year the laboratory was moved to Kuala Lumpur and in 1912 permanent buildings were acquired on Petaling Estate just outside Kuala Lumpur. An account of the first three years of operation can be read in Morgan's book *The Preparation of Plantation Rubber*. Finance for this work was originally guaranteed by twenty-nine companies, but with increasing interest in succeeding years the number of contributors to the research funds eventually reached 136.

From early investigations on tapping rubber trees, the scope of the work steadily widened, until six scientists were employed and a branch laboratory was opened in Ipoh. As time went by the Rubber Growers' Association became alert to the need for coordination and extension

of research for the rubber planting industry in S.E. Asia. The final recommendation that an institute for rubber research should be formed was made in 1920, after consultations with the Government and as a direct result of a memorandum prepared by Dr E.J. Butler, Imperial Mycologist to the Government of India, and Mr L. Lewton Brain, Director of Agriculture, Federated Malay States and Straits Settlements. During the next year or two various plans were considered in Kuala Lumpur, and in due course the scheme for the Rubber Research Institute was first approved in Federal Council in November 1924, and the Bill to incorporate the Institute was finally passed in June 1925. Funds were provided by a cess on rubber exports. The first Director assumed office in September 1926 and before long a staff of just over twenty officers, including some who had been working under the Rubber Growers' Association, was functioning.

Similar stories can be told for other rubber growing areas in S.E. Asia and research organisations exist in Ceylon, Indonesia and IndoChina. The war years 1939-45 saw the creation of a synthetic rubber industry in the United States of America, and this has become an incentive to all natural rubber growers.

With the recent publication of the *Report of the Advisory Committee Enquiring into Production, Development and Consumption Research in the Natural Rubber Industry*—the 'Blackman Committee Report'—our research is about to enter a further phase of development.

Correspondence

The Editor invites letters for publication in this column.

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HOLT WEED BREAKER

We much appreciate the careful trials you have made with our machines and the objective report which appeared in *Planters' Bulletin* 31. We wish to comment on one or two details, with reference to experience in Africa.

Damage sustained—The conditions on the estate probably resembled those under the power lines in Northern Rhodesia. There tree stumps—up to three feet high and screened by regenerated bush—may cause damage to the tractor, if not to our implement, when it is carelessly driven. Lately, to avoid this possibility, trees have been cleared initially down to ground level. We sup-

pose that rubber planters will eventually adopt this practice.

Soil disturbance—Where cover is scanty the lighter model could be employed. If the implement is worked up and down slopes the cups cut in the ground run parallel to the contour, which facilitates penetration of rain and so checks erosion.

The Holt Weed Breaker Co.

J.L. Illingworth

Technical Adviser

A fair amount of mechanical clearing is now being carried out and this practice is likely to increase, thus favouring the use of mechanical weed cultivation. We fully agree that the best results in mixed covers will require intelligent management of machines.

Although gullyng may be avoided by using the machine up the slope, we consider that some sheet erosion may yet take place.—Editor

Superior Processing Rubber

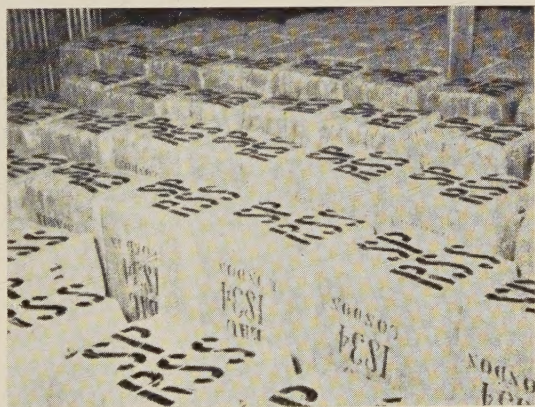
SUPERIOR PROCESSING RUBBER is the name given to a form of natural rubber* in which a portion of the raw rubber is vulcanised before coagulation. SP rubber has been successfully prepared in the form of a thin pale crepe, as smoked sheet and as air dried sheet. We can now report progress upon the production of each type of SP rubber.

SP Crepe was the first form in which this rubber was prepared, and the process was described in 1955 in *Planters' Bulletin 21*. Ten pound samples were distributed in the United Kingdom, followed by hundred-weight quantities for full evaluation and then ton lots for full scale factory trial. Twentyfive tons were made at our Experiment Station, Sungei Buloh.

In November 1955 The East Asiatic Company began production of SP crepe under licence at their Taiping factory. During 1956 some 54 tons were made but production has been doubled during the first half of 1957 and is likely to increase still further towards the end of this year. Enquiries from interested manufacturers have centred in the U.K., but the U.S.A. have been well represented and substantial amounts have also been supplied to New Zealand, Scandinavia and Australia.

SP Sheet, Smoked and Air Dried - This experience convinced us that there was a substantial field for SP crepe, and led us to suspect that there would be an even larger market for a cheaper SP rubber suitable for manufacturers who normally use RSS grades rather than crepe. This became especially evident in 1956 when the premium for pale crepe reached 22 cents (Malayan). We therefore turned our attention to producing SP rubber in the form of smoked sheet and air dried sheet. This was successfully accomplished using the same formulation as for crepe and 10 cwt of each kind were sent to the U.K. during 1956 and to the U.S.A. early in 1957 for distribution as samples to manufacturers for laboratory trial. This was usually followed by purchase of hundred-weight quantities. Many of these manufacturers were then supplied with ton lots made at our Experiment Station so that they could establish for themselves, by factory trials, that SP rubber improved their products. Some of these users are now placing regular orders. During 1956, 9 tons of SP RSS were made and despatched mainly to the U.K., In the first six months of 1957, 47 tons of SP RSS and 19 tons of SP air dried

A view in the packing shed of bales of SP sheet packed and marked ready for despatch.



* prepared according to British Patent Application 7770/54.

Superior Processing Rubber

sheet have been shipped from Malaya. Our factory at Sungei Buloh is now devoting its entire crop (about 1 ton per day) to the production of SP sheet and we shall continue to manufacture SP rubber until commercial supplies become available.

FACTORY REQUIREMENTS FOR SUPERIOR PROCESSING RUBBER PRODUCTION

The process for preparing vulcanised latex has been slightly modified from that described in *Planters' Bulletin 21* and a reduction in costs has been achieved without any sacrifice in the quality of the product.

Suspension - The first step in the process is to make a stable suspension in water of the chemicals necessary for rubber vulcanisation. This is done by grinding the dry chemicals in a ball mill in the presence of water and a dispersing agent. The formula for the suspension is now as follows, the quantities quoted being those required for vulcanising 1,000 lb rubber (for 5,000 lb SP rubber):

Sulphur	20. lb
Zinc oxide	7.5 lb
Zinc diethyldithiocarbamate	2.0 lb
Mercaptobenzthiazole	4.0 lb
Dispersol LR	0.4 lb
Water	48.1 lb
Total	82.0 lb



A batch of vulcanised latex in the vulcanising tank.

For vulcanisation, strained field latex is ammoniated to 0.3%, the d.r.c. is estimated from the total solids determined by drying an accurately weighed 5 to 6 gram sample of the latex in a Petri dish for two hours in an oven at 160° F, and then an amount of vulcanising suspension equal to 8.2 % of the weight of rubber present is added.

The latex is then heated by live steam injection so that it reaches

180°F in one hour and is held between 180 and 185°F for about two hours. The simple test described in *Planters' Bulletin 21* (page 99) indicates when vulcanisation is complete. Previously clarification of the vulcanised latex was recommended but this is no longer regarded as necessary.

Superior Processing Rubber

Vulcanised latex is then blended with diluted field latex in the required proportions and run into coagulating tanks. Thereafter the coagulation, machining, drying, and packing of the rubber are identical to ordinary rubber manufacture.

For smooth running of the process four things are essential:

Thorough grinding of the vulcanising suspension

Complete vulcanisation of the vulcanised latex

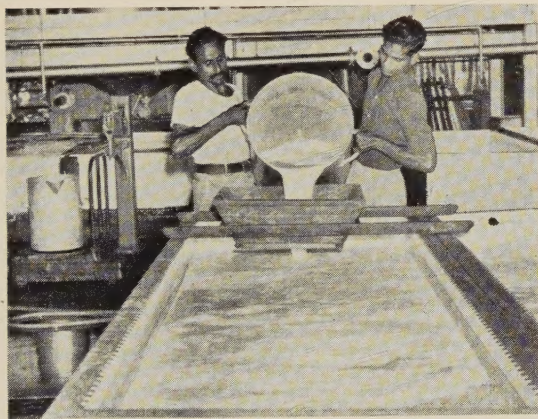
Good mixing in the vulcanisation and blending stages

Accurate addition of the vulcanising suspension and proportioning of vulcanised and unvulcanised rubber in the blended latex

All these factors can be controlled if proper attention is paid to the design of the plant. We will now describe briefly the plant requirements for an output of 1 ton per day of SP rubber.

Plant - The size of vulcanising tank selected will be a compromise for preparing a stock of vulcanised latex say once per week which will involve large tanks and complementary steam plant, and for vulcanisation say every day with smaller tankage and proportionately smaller steam demand. We suggest a vulcanising tank fitted with a slow mechanical stirrer with a net capacity of 500 gallons, i.e. sufficient for 3 tons of SP rubber. This would be charged with latex on the first day, vulcanisation would be carried out on the second day, and the first withdrawal of one third of the quantity would be made on the third day. For continuous operation the remainder would have to be run into a buffer storage tank, leaving the vulcanising tank free to receive latex on the following day to recommence the cycle.

At this scale of operation a suitable boiler would be one giving an output of about 400 lb steam per hour, and the total volume of the ball mill would be 30 gallons. The blending tank for preparing the mixed latex should be of 1,500 gallon net capacity to allow dilution to 15% d.r.c. A mechanical stirrer is needed to ensure good mixing of the vulcanised and unvulcanised



Vulcanised latex being added to field latex in a coagulating tank.

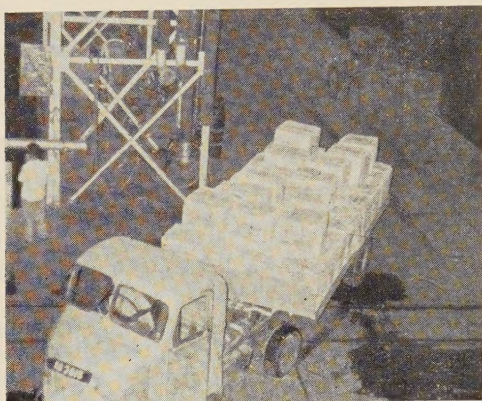
latexes. Recommended details for these items of plant are:

Ball mill in mild steel

19½ inch internal diameter

29 inch internal length

Rotation 35 r.p.m.



A five ton consignment of SP RSS on the dockside at Port Swettenham.

Vulcanisation tank in mild steel coated with a paint resistant to latex and heat

4 ft 7 inch diameter

5 ft 10 inch deep at cylindrical section

Conical bottom

Flat paddle stirrer 3 ft × 6 inch rotated at 30 r.p.m. by 2 h.p. motor.

Blending tank in aluminium or painted mild steel

6 ft 7 inch diameter

8 ft 7 inch deep at cylindrical section

Conical bottom

Flat paddle stirrer 4 ft 4 inch × 9 inch rotated at 20 r.p.m. by 3 h.p. motor.

The cost of these items with a suitable supporting structure for the tanks and access platforms would be something like \$15,000 (Malayan). A package boiler, which could be installed in a factory with little trouble, would cost say a further \$8,000.

COSTS

The foregoing gives a general idea of the capital outlay involved but many estates will already have equipment which can be used direct or with slight modifications. The above is only an example of the plant required and we shall be pleased to advise individual estates as to how the process can be run in the most economical way to suit their particular conditions.



The same consignment in the hold of the mv Memnon.

Superior Processing Rubber

The direct costs of production additional to those incurred when making normal sheet or crepe are approximately:

Chemicals	0.34 cent/lb
Labour	0.17 cent/lb
Steam	0.17 cent/lb
Electricity	0.34 cent/lb
Depreciation (spread over 10 years)	0.33 cent/lb
Total	1.35 cent/lb

During the development period SP rubber has been sold to the user at 1d sterling (3.57 cents) above the cost of the equivalent grade. This premium allows the producer a reasonable profit on his extra manufacturing cost and yet is not too high to prejudice a prospective customer against trying SP rubber*. When manufacture is fully established the laws of supply and demand will determine the premium which SP rubber deserves.

CONCLUSIONS

Consumer reaction to SP rubber has been so favourable that we consider it is a product which has a bright future. The Rubber Research Institute of Malaya now has outstanding orders which will require two months to execute and the demand has grown steadily through 1957. SP sheet has been sent to the U.K., the U.S.A., Australia, Portugal, Mexico and South Africa in quantity. Samples have gone to Japan, Czechoslovakia and New Zealand.

If the producing industry is to reap the full benefits of this interest it must ensure that demands for large production quantities can be met quickly so that the consumer can get his supplies in the required quantities and at the right time. We foresee that the demand will soon outstrip the present production capacity, and other producers will have to enter the field if the favourable position of this new natural rubber product is to be sustained.

The plant required is not extensive, the process is relatively simple to operate, and the price which consumers are willing to pay adequately covers the extra costs involved.

We believe that SP rubber is an important development in improving natural rubber. Your research organisation has brought production as far as its resources permit and now seeks to hand over the product as an established commodity to Malayan producers to put SP rubbers on the market in quantity.

* We are indebted to the United Baltic Corporation both in London and New York for their ready cooperation in maintaining this premium during the development period.

Foundations for Oil Engines

We again have pleasure in presenting a guest article by the Deputy Chief Inspector of Machinery of the Federation of Malaya. An article on further aspects of the installation of machinery in estate factories will follow.

THE FIRST STEP in the installation of any engine, that is intended to be kept permanently on the site, is the preparation of a suitable foundation. The type and size of foundation required depends on such varied factors as the horsepower, number of cylinders, whether vertical or horizontal, speed of rotation, the method of transmitting the power to the driven machinery and the nature of the ground.

There is no reliable formula, incorporating all of the above factors, which will allow the dimensions of a foundation to be calculated. On good substrata, foundations vary in size from 10 cubic feet per horsepower for a large, slow, horizontal engine to what is virtually no foundation at all for a skid mounted, high speed, multicylinder engine. Irrespective of the type of engine, the foundation must satisfy three requirements: it must be capable of carrying the weight of the engine without undue settlement; it must maintain correct alignment with the driven machinery; and it must be capable of absorbing the vibrations and noise which may be caused by unbalanced forces.

The suppliers of an engine generally provide a drawing of the foundation. Frequently the drawing shows little more than an outline of the foundation, the positions of the holding down bolts, and a note that the foundation should be carried downwards until solid ground is reached. The suppliers' instructions should, of course, be followed. Unfortunately the critical dimension, the depth of the foundation, cannot be stated as it depends on the nature of the subsoil. There are, however, certain considerations that should be kept in mind in this connection. These are firstly, the depth of the foundation block should never be less than 24 inches and, secondly, the foundation should be, wherever possible, above the general water level of the site. If these conditions are fulfilled the depth, on a reasonable subsoil, may be calculated from the volume of the foundation shown below:

<i>Type of engine</i>	<i>Volume of foundation (cub.ft/h.p.)</i>
Single cylinder vertical engines 1000 r.p.m. or over	4 to 5
Single cylinder horizontal engines low speed	8
Multicylinder vertical engines 1000 r.p.m. or over	2 to 3
Multicylinder vertical engines low speed	2½
Multicylinder horizontal engines low speed	4 to 6

In this country the common subsoils are laterite, clay, sand and peat. The latter is undoubtedly the worst. If other considerations make it

Foundations for Oil Engines

essential to instal an engine over peat, the foundation should be a reinforced concrete raft resting on piles and kept at as high a level as is practicable. Laterite, or a mixture of laterite and gravel, is excellent material upon which to build foundations. Any alluvial material caused by the decomposition of the gravel should be removed. Clay subsoils are very variable. If the drainage is arranged so that water does not come into contact with the clay and at the same time the clay is prevented from drying out it can be relied upon to carry a foundation. Where such conditions cannot be obtained it is advisable to build the foundation on piles. One authority goes so far as to recommend that no foundation in clay should be less than five feet deep. Foundations on dry sand are perfectly satisfactory, but a sandy subsoil should always be regarded with suspicion, since wet sand is unsafe. If there is any possibility of water coming into contact with the sand the foundation should be surrounded by sheet piling to prevent the escape of the sand.

Once the position of the centre line of the engine is fixed the next operation is to excavate the foundation in accordance with the suppliers' drawing and to a suitable depth. In deep firm subsoil an excavation the same size as the foundation is often sufficient. In this way shuttering is unnecessary at the lower levels. Except for a small engine it is unusual for the foundation block to have the same horizontal section at all levels. Shuttering will be required from the change of section to the level of the bedplate. Where the foundation is cast in two or more horizontal sections it is necessary to provide keys between the various sections. A convenient method is to embed baulks of timber in the upper surface of the first layer and to remove them as soon as the concrete is sufficiently set. Thus several horizontal chases are left in the upper surface, which are filled when the next layer is poured. Foundations for small engines should always be cast in one piece.

Provision has to be made for the holding down bolt holes in the foundation. One method is to make a light wooden template of sufficient size to rest on the edges of the shuttering. On the central lath of the template the centre line of the engine is marked and the positions of the holding down bolt holes are marked on parallel or cross laths. Open ended wooden boxes long enough to accommodate the holding down bolts are made from timber lightly nailed together. The cross section of these boxes varies slightly with the type of holding down bolt, but 3 inch $\times$ 3 inch or 4 inch $\times$ 4 inch are convenient sizes. If two opposite sides of the box are made slightly longer, they can be used to attach the box to the template. With small engines, cylindrical carboard formers made useful boxes. Whatever type of box is used, it must be easy to remove after the foundation has set. A point worthy of attention is the distance between the edge of the core box and the nearest shuttering. This distance must be sufficient to allow the mixture to be worked into the space between the box and the shuttering; it should not be less than two inches. The core boxes and shuttering should be lightly greased, oiled or soaped to prevent the concrete from sticking to them. The centre line of the template is then checked with the centre lines of the engine and shuttering, and the foundation is ready to be poured.

A good mixture for a foundation is 1 of cement, $2\frac{1}{2}$ of sharp river sand and 4 of washed gravel or hard broken stone of a size that will pass through a 2 inch ring. For a large foundation it is possible to economise by using a weaker mix of the proportions 1 : 4 : 6, but this should not be used where the foundation is likely to be in contact with oil. Further economy can be effected by placing large stones - plums - in the mix. Only sufficient water should be added to make a workable mixture. The water should be neither acid or alkaline; any water that is suitable for drinking can be used with confidence.

After pouring, the concrete should be worked by vibrating or tamping to remove all the air and to ensure that no voids are left. This is particularly important in way of the bolt boxes and any horizontal shuttering. The tamping action will cause the level of the mixture to sink slightly and bring some of the water and fines to the top. More of the mix should then be added to bring the level to about one inch below the edge of the shuttering. No attempt should be made to obtain a smooth surface. The concrete should then be left to mature or cure for from six to ten days. Rapid hardening cement allows this period to be greatly reduced. It is advisable to cover the exposed surface of the concrete with wet sacks during the curing period. The shuttering and the holding down bolt boxes can then be removed and the foundation is ready to take the engine.

The foregoing has dealt only with the foundation for the engine. If the engine and the machine it drives are mounted on a common bedplate the foundation will consist simply of a block of concrete, of sufficient size to accommodate the bedplate and its holding down bolts, and of a depth determined by the nature of the subsoil. For an engine provided with an outboard bearing it is strongly advised to make the horizontal dimensions of the foundation sufficient to include the pedestal for the bearing. Where the engine is directly coupled to its driven machine there is much to recommend a common foundation block.

A. NEILSON

Fertiliser Nomenclature

Although the United States of America appear to be about to follow the good example of Scandinavia, by making an official change in fertiliser terminology on the lines discussed by our Editorial in *Planters' Bulletin* 24, we regret that we have been unable to secure the agreement within Malaya which we expected a year ago (*Planters' Bulletin* 26, page 98). Some commercial objection still remains but if, as

we hope, we are able to overcome this, the present artificial and misleading nomenclature should disappear from common usage.

By expressing the content of phosphate or of potassium as the element, the declared analysis would appear numerically smaller. Because of this, suppliers of fertilisers may have grounds for supposing that planters would think that nutrient contents had been lowered. Nevertheless, such a change will doubtless take place in most countries in the fulness of time.

Clonal Seed Collection Areas in Malaya and Their Improvement

PLANTING WITH HIGH YIELDING MATERIAL is an essential condition for the payment of grants in the approved schemes for assistance in replanting and new planting of rubber, now in operation under The Rubber Industry (Replanting) Fund Ordinance, Federation of Malaya No. 8 of 1952. For the purpose of the enactment, high yielding material has been generally defined in the following terms:

“high yielding rubber” means rubber trees grown from planting material which has been, or may from time to time be, recognised by the Rubber Research Institute of Malaya to be high yielding and which has been obtained from a source approved by the Board, or of which the Board may from time to time approve, after consultation with the said Rubber Research Institute.

Whilst it is possible by inspection of an area planted with budgrafted trees to establish with certainty whether approved high yielding material has been used, it cannot be established with certainty by inspection that an area planted with clonal seedlings is in fact planted with approved high yielding material. The Boards of Administrators of the Government Rubber Replanting Schemes therefore need to take all reasonable steps to ensure that only approved material will be used in clonal seedling plantings and, in this connection, to seek the advice and assistance of the R.R.I. as required by the enactment.

Our recommendations for the collection and testing of clonal seeds from large scale plantings of high yielding clones were first published in September 1940 and have been distributed in more specific detail by advisory leaflets from 1947 onwards. Before that time our Botanical Division had established a number of clonal seedling trials in the main rubber planting districts of Malaya. These trials, which have been in tapping for ten years or more, have clearly shown that clonal seedlings derived from a wide range of budgrafted plantings containing a number of the older well known proved clones are capable of high yields, yields that have not fallen far short of those obtained from budgrafted trees of the older proved clones or from clonal seedlings obtained from carefully planned isolated seed gardens. The article ‘A Speculation in Seed’ in *Planters’ Bulletin* 15 (page 112) refers to these results. Clonal seedlings of Tjir 1 parentage, consisting mainly of selfed seedlings of Tjir 1 collected from large scale monoclonal plantings, have proved to be some of the highest yielding and otherwise satisfactory clonal seedlings in our trials.

On the evidence from these trials, further strengthened by evidence from our continued breeding work (twentyseven clones of the RRIM ‘600’ series clones – RRIM 600 to 630 – have Tjir 1 as one parent), and also because the clone has been widely used in large monoclonal plantings throughout Malaya, interest has centred in the provision of large supplies of reliable Tjir 1 clonal seedlings, especially for smallholders’ replanting.

In fulfilment of our obligations under The Rubber Industry (Replanting) Fund Ordinance, we have cooperated with the Boards of Administrators and with the owners of potential sources of valuable

Clonal Seed Collection Areas in Malaya

high yielding clonal seeds, in the work of inspection and approval for registration of suitable seed collection areas*.

TWO IMPORTANT POINTS

It is necessary to emphasise two important points. First, it is only the source of high yielding clonal seeds that is approved by the R.R.I. The owner of an approved source of clonal seeds is responsible for ensuring that the limits of the collection area are rigidly observed and that seed collection is strictly supervised. Every supplier should be prepared to certify each consignment of seed from an approved collection area and the purchaser should see that he gets such a certificate.

Secondly, it must be emphasised that whilst the R.R.I. is the recognised authority under the enactment for the approval of high yielding planting material as such, this does not mean that the R.R.I. positively recommends all such material for large scale planting. On this point there is evidence of much misunderstanding and we wish strongly to recommend anyone who may be in doubt about the advisability of using any high yielding planting material – more especially clonal seedlings – of which the sources are listed in the official schedule published by the Boards of Administrators of Government Rubber Replanting Schemes, to consult the R.R.I.

We have always been willing to give advice and to provide the services of expert clone identification inspectors in making potential clonal seed production areas suitable for the collection of reliable high yielding or otherwise valuable seeds. However, there were few requests for inspection and indeed few attempts made to implement our recommendations when given until recently when, as a matter of administrative policy in the provision of authentic high yielding clonal seeds for large scale replanting by smallholders, official controls and conditions were introduced.

PRESENT POLICY AND PROCEDURE FOR REGISTRATION OF CLONAL SEED COLLECTION AREAS

Since the acceptance of the Institute's recommendations by the Boards as mentioned above, it has become necessary to implement a policy of inspection, and until adequate remedial measures are taken areas which do not meet the requirements are not registered as approved sources of clonal seed. At first with reference to areas supplying seed to the Department of Agriculture for the use of smallholders, and now for all areas which are to be registered as approved sources, the following procedure has been established.

An R.R.I. clone identification inspector visits the proposed collecting area and lists the clones present, the approximate percentage of each and their distribution both within the area and within a boundary belt of five chains width surrounding it. The inspector marks all trees such as seedlings or buddings from rogue budwood (often due to stock

* A brief description of the procedure was distributed in January 1957, as a special leaflet issued with *Planters' Bulletin* 28. Since then over 7,000 acres of potential clonal seed producing areas have been examined, tree by tree, by R.R.I. inspectors and approximately 5,000 acres have been approved as collection areas for high yielding clonal seeds.

Clonal Seed Collection Areas in Malaya

shoots in the nursery) which are considered undesirable seed parents. He also indicates the limits of the seed collection area, paying special attention to any boundary belts against seedling plantings from which seed must not be collected.

The proprietor can then choose whether he will eliminate all trees marked as undesirable or decline to develop the area for clonal seed collection. If he agrees to the corrective measures suggested a second inspection follows to confirm that they have been completed. The approved area delimited within such boundary belts as are required will then conform to the recommendations, that the seed collection area is planted with budgrafted trees only and is separated by five chains from any seedling rubber.

Where seedlings or trees of another clone are present in, or adjacent to, an otherwise monoclonal planting, the seedfall is usually markedly increased in their proximity. This is presumably due to cross pollination and has advantages and disadvantages. The most unfavourable feature is that undesirable rogue parents may contaminate the progeny out of all proportion to their number. It is for this reason that if the rogues are not eliminated before flowering takes place an area cannot be approved for the ensuing seedfall season, because it must be presumed that cross pollination with undesirable parents will have taken place and many seeds of doubtful parentage will be present in the seed crop.

It follows that advantageous effects may be expected when different clones are adjacent or intimately mixed as in a specially designed seed garden. The seed crop will be increased and the bulk of the progeny will be the product of cross fertilisation, unless exceptionally self fertile clones are present. The performance of the selfed progeny of most clones is markedly inferior to that of cross fertilised seedlings from the same parent clones. Even with Tjir 1 – which clone is exceptionally self fertile and whose selfed seedlings are much more vigorous and productive than other known selfed seedling families and satisfy the criterion for ‘high yielding material’ – the seedfall will be increased by crossing with other clones. If the latter are good parents the performance of the progeny may well be improved. Where a male or female sterile clone can be introduced, it may be assumed that the increment in seedfall represents seed of a nature hitherto only available by hand pollination.

IMPROVEMENT OF SEED COLLECTION AREAS

The elimination of undesirable rogues concerns strictly only the crowns which bear the flowers, and although it is often practicable to fell or poison such trees, an alternative is to top bud them. The same clone, usually Tjir 1, may be used for this purpose if a monoclonal area is desired, but from the foregoing observations it follows that an improvement may be effected by budding rogue trees with good seed parent clones other than that already present. Thus, for example, budding rogues with PR 107 – which according to information from Indonesia does not set much seed but is an excellent pollen parent – in a monoclonal block of Tjir 1 may be expected to improve the seedfall and value of the progeny after the PR 170 trees begin to flower. The crown of PR 107 is fairly wind resistant and free from disease, thus it is

Clonal Seed Collection Areas in Malaya

particularly suitable for use in patches where Tjir 1 trees have been lost due to wind damage, and clonal seedling supplies have been planted to fill the gaps.

Where it is desired to bud rogues in Tjir 1 areas on coastal soils, where pink disease is rare, RRIM 501 would be an alternative or addition to PR 107. Similarly, RRIM 526 could be used in inland districts, but with Tjir 1 only as RRIM 526 has not been tested in other crosses. The progeny of these RRIM '500' series clones crossed with Tjir 1 may be expected to have average vigour and enhanced yield capacity.

Seed from these areas may be used, not exclusively for rearing clonal seedling trees for tapping, but also as stocks for budgrafting. Of course, there is no need to use seed from approved areas as stocks, but experimental evidence on stock/scion effects has indicated that certain families of clonal seedlings, but not all, improve the growth and yield of the scions grafted upon them. The most important factor appears to be that the stock seedlings should be of a vigorous family, but potential high yield capacity of the stocks may have a small beneficial effect especially when the tapping cut on scion bark nears the union. Cross bred progeny are generally more vigorous than selfs, thus cross bred seed of parents known to give vigorous, high yielding clonal seedling families would appear to be ideal stock material.

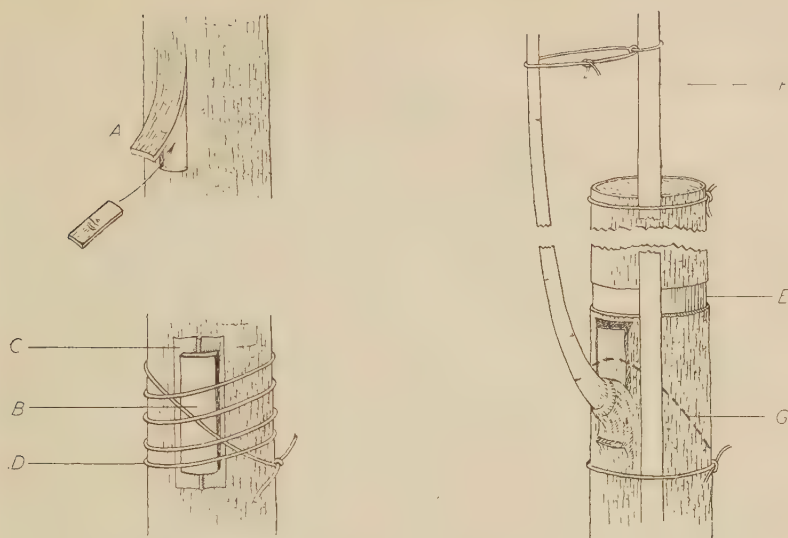
Crown Budding – The technique of budding stocks of normal size is familiar but some notes on crown budding large stocks may be of value. Frequently seedling rogues in budded stands have developed as volunteers in vacancies caused by wind damage or by disease (often dating from the Japanese occupation in Malaya) and are now sizeable trees. They may be budded high above the tapping panel, where the girth makes budding still practicable. Ordinary brown budwood is best, there is no need to seek buds from trees of like girth.

The budslip is prepared in the normal manner. The flap of bark on the scion is opened from the bottom upwards, the budslip is inserted, the flap replaced and covered with a piece of palm frond as in normal budding procedure. The major deviation from the usual method is in the manner of binding. A rectangular splint (4 inch $\times$ 1 inch) cut from a large bamboo stem is placed on top of the palm frond covering the position of the budslip. Twine is run over the bamboo splint and bound tightly. This procedure gives adequate pressure on the graft. Afterwards the twine should be run round over the top and bottom margins of the palm frond covering to ensure a good seal against moisture. A skilful budder can make several adjacent buddings to increase the chances of a success on each seedling.

This method has been used successfully on seedlings up to 24 inches in girth at four feet from the ground. The budding is opened after about three and a half weeks and is cut back a fortnight later, when the tree is sawn off about a foot above the point of budgrafting and a ring of bark one inch wide is cut away to the wood immediately above the bud patch.

The young scion shoot often grows fast when it comes away and is liable to wind breakage at this tender stage. A stick should be tied firmly to the tree, a piece of twine tied tightly to the stick, and a loop

Clonal Seed Collection Areas in Malaya



High budding large stocks. Modifications of the normal budding procedure for large stocks, and at a greater height than usual, are shown in the above sequence.

- A The flap is marked to open from below upwards.*
- B Before binding, a bamboo splint is placed over the bud covering to permit greater pressure to be applied.*
- C The twine is run over the palm frond here also.*
- D Twine is tied tightly.*
- E On cutting back, a ring of bark is removed here.*
- F The young tender shoot is loosely tied to a stick, which has been firmly secured to the tree below.*
- G Approximate line along which snag will be cut.*

passed loosely about the young scion shoot to steady the latter without harming it.

When the new shoot has several feet of brown wood the snag is sawn off by a cut from below the level of the budding on the far side passing obliquely upwards to just above the base of the new shoot. The snag surface should be dressed as in normal practice.

Removal of Rogue Trees – The alternative to crown budding is cutting out or poisoning. Cutting out is definite and final, but poisoning is sometimes more attractive. The choice then lies between poisoning with sodium arsenite or with 2,4,5-T. There is a risk that poison will be transmitted by root grafts from the tree to be killed to adjacent wanted trees. Close inspection of most suspected cases of such transmission shows that in fact a substantial quantity of poison solution was spilt on an exposed root. However, perfectly genuine cases do occur and the risk is greater with sodium arsenite than with 2,4,5-T. The use of

2,4,5-T allows rogue trees to be profitably tapped during elimination, but has the disadvantage that the destruction of the tree takes longer, usually six months and sometimes a year. During this period there may be sporadic defoliations and refoliations, including flowering which can coincide with the main flowering of the seed garden; thus approval of the clonal seed collection area is delayed until the flowering season after the complete elimination of rogue crowns.

The inspection of prospective clonal seed collection areas is time consuming and the corrective measures for their improvement are sometimes costly; however, the trade in clonal seed is profitable. Suppliers should be prepared to do everything possible to ensure that their seed collection areas are of the highest quality and that the collection itself is closely supervised so that the limits are observed. Furthermore, at the beginning of the seedfall all old seed should be cleared away and discarded. Seed collection should be frequent—every third day is suitable, and daily if the seed crop justifies it at the height of the seedfall season. This ensures that the seed is fresh and will germinate well.

When seed is collected from mixed clonal areas the quality may be considerably improved by selecting the seed borne by the best parent clones and discarding that of the poorer parent clones. The seeds of different mother clones may be recognised by their shape and the pattern of the seed coat markings. This procedure should be declared together with the origin of the seed, to reassure purchasers that special sorting has been done to improve the quality of the seed and not to disguise its nature.

In adopting the Institute's recommendations the Administrators of the Boards seek to ensure that material of the highest quality is employed by those participating in the Government Rubber Replanting Schemes, and this is very desirable for the welfare of the industry. Since it is the smaller rubber grower who is planting clonal seedlings most extensively, there is an added moral obligation on the suppliers of clonal seed to provide fresh seed 'true to label' collected from approved areas in strict accordance with the regulations.

We shall continue to advise on the suitability of mixed clonal and Tjir 1 monoclonal areas for seed collection and to provide the services necessary for implementing the policy of improving the clonal seed collection areas.

Mineral Nutrition

The special glasshouse used by Dr E. W. Bolle-Jones for his studies on the nutrition of hevea has been described by him, together with drawings and photographs, in a paper entitled 'A Glasshouse Suitable for Physiological Investigations on Plants Grown in the Tropics', which

appeared in *The Empire Journal of Experimental Agriculture*. Further aspects of our studies on the mineral nutrition of hevea have been communicated by Dr Bolle-Jones and Mr V.R. Mallikarjuneswara to the scientific journals *Nature* and *Plant and Soil*. Fuller accounts will appear in due course in the *Journal of the Rubber Research Institute of Malaya*.

Despatch of Planting Material

ALTHOUGH THE MAIN SUPPLIERS of clonal seeds and budwood have acquired considerable experience in the packing of these materials for transport to the user, unnecessary losses still occur especially when new suppliers enter the field. This is disappointing for all parties.

Clonal Seeds – The simplest and best way is to supply fresh seeds ungerminated. At the beginning of the seedfall season all old seeds are cleared from the seed collection area and destroyed; thus only fresh seeds are picked up in the regular rounds. At the same time customers must be warned to be prepared to accept delivery. The best results are obtained when there is understanding and cooperation on both sides.

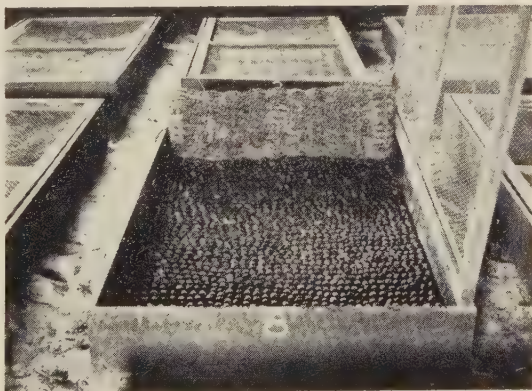
Fresh seeds may be stored in a cool place for a few days, but the object should be to reduce to the minimum the interval between gathering and use. When there are enough seeds to make up a consignment, it should be despatched, even if this does not make up the whole order. The purchaser will have to set out the seeds for germination and he can often handle consignments of a moderate size more easily. Time is saved if the seeds are weighed instead of counted – reckon one pound equals 100 fresh seeds.

Fresh ungerminated seeds are put in gunny bags, without any other packing material; double gunny bags are a wise precaution unless only private transport will be used for delivery. Sew the mouth of the bag carefully and affix labels showing the destination and the request **KINDLY HANDLE WITH CARE: RUBBER SEEDS: PLEASE DO NOT LEAVE IN THE SUN.**

Ungerminated seeds may be stored longer in damp charcoal, as described later for germinated seed in long transit.

Germinated Seed – A bed of coir dust, husks or sawdust six inches deep should be prepared in a well drained position. Rarely, sawdust contains toxic resins; this is a small risk but a preliminary trial with the sawdust is worthwhile. The bed is thoroughly moistened and the seeds are set flat side down on the surface. Shade must be provided, either by an atap canopy or, better, by laying coconut matting over the surface of the seeds. This should also be kept moist. When dealing with large quantities of valuable clonal seed, an enclosure of fine wire netting will secure the beds against rodents.

Germination bed for clonal seeds. The coir matting covering has been rolled back to allow inspection of the seeds, set on their bed of damp sawdust. The wire netting covers are to exclude rats.



The seeds are watered and inspected daily. As soon as the coat cracks and the root begins to emerge, the germinated seed must be

despatched or planted out. Seeds which germinate late should be discarded. Germinated seeds are packed in boxes between layers of damp fibre or sawdust. The seeds should again be laid flat side down and the boxes marked PLEASE KEEP THIS : TOP : SIDE UP. Otherwise a delay in transit may result in a twisting of the roots, because development is rapid at this stage. During unpacking care should be taken not to break the young roots.

For long journeys, germinated seed may be packed between layers of damp charcoal powder (add 20% of water by weight) in sealed tins, but this refinement is not necessary in ordinary traffic.

Seedling Stumps - A supplier with surplus clonal seeds on his hands is recommended to plant them in a nursery and raise seedling stumps. This nursery should be properly labelled so that there is no confusion with unselected material. Deformed, yellow leaved seedlings and those lacking in vigour should be discarded.

Seedling stumps are pulled when as thick as a finger at the base, with at least 18 inches of brown bark. The shoot is cut at 15 inches and the cut end dipped in melted wax after removal of coagulated latex. The tap root is cut cleanly at 12 inches and laterals are pruned to 4 inches. Bundles of stumps are wrapped in damp sacking, but if the journey will be long extra sacking, damp fibre or lalang should be used around the outside and the whole sewn up.

Budwood - After cutting into one yard lengths, both ends are dipped into warm wax. Each stick must be individually wrapped to prevent bruising and rubbing of the buds. For short distances, *Mikania* or cover crop may be used, only the outer cover being of sacking. For long distances coconut fibre is entwined or sacking is wrapped around each stick. Slit plantain or banana stems make protective sheaths also. The internal packing material should be just damp to the touch. The best external protection is obtained by packing in boxes, but well padded sacking may be used as a substitute.

Budded Stumps - These require a combination of the techniques for seedling stumps and budwood. Special care is needed to protect the single grafted bud by tying on a guard of banana stem or fibre, and to see that roots are not too severely pruned back.

Final Points - When planting material is exported from Malaya no packing such as lalang or banana stem sheaths should be used, because of disease risks. Success in despatch of planting material depends on good packing, coordination with the transport service so that none of these materials is exposed to the sun or bruising, and cooperation between supplier and user.

Termite Control

A note in *Planters' Bulletin* 26 records the remarkable persistence of aldrin and dieldrin in treated soils. Continued observations in the same tests have shown that, of the two, dieldrin

remains active longer. Aldrin, the cheaper material, is satisfactory except on peat and coastal alluvial clay, where attacked trees should be treated with Dieldrex 15 applied at the standard rate of 1 in 300 on clay; for peat, four times this concentration is recommended.

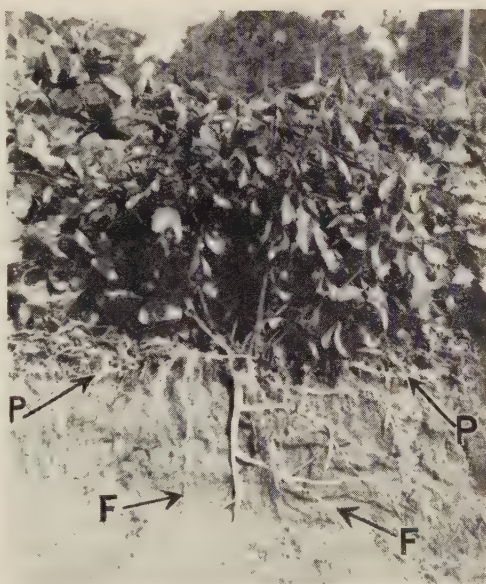
Propagation of Flemingia

FLEMINGIA HAS PROVED USEFUL AND POPULAR on estates in the years since it was described as a new legume bush cover plant in *Planters' Bulletin* 5. But the principal disadvantage of a shrub cover such as *Flemingia congesta* is that it does not spread as rapidly as a creeper over the soil surface during the early stages of establishment, and consequently some soil wash may take place on slopes. However, a mixture of *Flemingia* with the creeping legumes has been used successfully to overcome this difficulty. Rows of the creepers and shrub cover are planted separately.

Flemingia congesta has two advantages. First it roots deeper than the creeping legumes, circulating soil nutrients from greater depths and aerating the soil more thoroughly. The second advantage is of a longer term nature. A dense cover of creeping legumes suppresses the growth of shrub and tree seedlings and, when these legumes are shaded out by the developing canopy of the rubber trees, shade tolerant grasses are likely to invade and dominate. Some of these grasses are most undesirable. However, if the *Flemingia* is controlled by light slashing to about two or three feet from the ground, this legume shrub will act as a nurse to any woody seedlings which arise; thus a succession leading to a ground cover of sown and natural shrubs can be more readily achieved in the mature planting.

A mixed cover of the softer shrubby species has been found to be especially satisfactory for hilly sites, where clean weeding of mature areas is impracticable due to the risk of erosion. The shrubs keep down such grasses as *Axonopus compressus*, which so often seem to be severely detrimental to the growth of rubber. Since *Flemingia congesta* tolerates shade much more than do most legumes, it is well adapted to assist this transition of the ground cover vegetation to a type most desirable under a closed canopy.

Quantities of *Flemingia congesta* seed have been harvested on our Experiment Station at Sungei Buloh, and this has been extensively used in our recent experimental planting, as well as for distribution to over 100 estates. Commercial production has begun in Indonesia and one of



A rooting profile of Flemingia congesta, showing the deep downward reach.

F *Flemingia*

P *Pueraria*

Propagation of Flemingia

the principal purveyors of cover plant seed is arranging to import *Flemingia* to distribute in Malaya. Revised recommendations for establishing, and for propagating, *Flemingia* are therefore timely.

Pretreatment - Small quantities of seed may be pretreated to improve germination. The most effective method is to place the seed in a glass or earthenware vessel, pour on just enough concentrated sulphuric acid to cover the seed, and stir with a glass rod to mix evenly. After twenty minutes, cautiously turn the whole into a large volume of cold water, and avoid allowing the concentrated acid to touch the skin or spit into the face. Decant the diluted acid and wash the seed by repeated changes of fresh water for two hours.

Alternatively, mix two volumes of boiling water with one of cold water and pour over the seed in another vessel stirring throughout until the seeds are well covered with the hot water. Leave for one hour and then drain off excess water. This treatment is not so effective as the sulphuric acid treatment. Be careful not to soak the seed for too long.

Either method of pretreatment speeds the rate of germination and involves soaking the seed; as a result the seed germinate irrespective of whether or not there is adequate soil moisture. In practice this would lead to losses during a dry spell and sowing should therefore be done in a wet season; in a nursery the seedlings may need watering.

Growth of a legume cover is improved by vigorous nodulation of the roots to fix nitrogen, and we advise seed inoculation. Seed of *Flemingia* should be inoculated after pretreatment. Cultures of root nodule bacteria to be used with *Flemingia* seed are supplied by our Pathological Division.

Planting and Aftercare - The seed are sown two or three to a point and the points are arranged three feet by two feet between the rows of rubber. The nearest line of *Flemingia* is planted six feet from the rubber. This planting system needs about one third of a pound of seed per acre. If creeping legumes are also to be planted, these are sown in drills replacing one or two rows of *Flemingia* according to the width of the avenues. Like other legumes, *Flemingia* benefits from phosphate manuring after germination. Ground rock phosphate may be dusted about the young plants at a rate of application up to one hundred-weight per acre. This dressing may be repeated six months and one year later if required. The *Flemingia* should be allowed to grow to five feet tall before it is slashed. As slashing twice a year is usually sufficient, upkeep costs are comparatively low.

Various pests may attack any legume seedlings. Snails can be controlled by poison baits as described in *Planters' Bulletin* 21 (page 107). Leaf eating insects sometimes attack *Flemingia* and are controlled by spraying a 0.25% emulsion of DDT or by dusting with a 5% DDT powder. However, *Flemingia* is usually fairly robust and we give these notes only as a guide in case of trouble or when it is intended to establish a strong stand rapidly in a nursery for seed production.

Seed Production - For seed production the planting system should be more open, say three feet by five feet, for ease of access to the bushes. The shrubs start flowering within one year of planting. Insect pests greatly reduce the production of seed unless the flowers and developing pods are sprayed with an insecticide. Dusts are unsuitable for

Propagation of *Flemingia*

this purpose as they do not readily allow good coverage. Wettable powders also are inferior to emulsions. When flowering has begun, we recommend spraying once every two weeks with one of the following proprietary materials, as available in Malaya:

	<i>Diluted</i>
Endrex	1 in 800
Dieldrex 15	1 in 300
DDT 25% emulsion	1 in 100

Although all these will reduce insect damage of the flowers and seed, Endrex is the most effective. The photograph shows how it can be applied most successfully using a Swingfog apparatus, which produces a fine fog of neat Endrex, or a half and half mixture with Diesolene. When fogging with Endrex the operator should be protected by goggles, and by a mask over mouth and nose.

Insecticides are best applied early in the day, before the flowers open; less insecticide is then deposited on the inner surfaces of the petals, which are touched by pollinating insects. When fogging, it is the more necessary to start early in the morning, while the air is nearly still. The direction of fogging should be chosen so that what



Fogging Flemingia with Endrex

air movement there is will carry the fog into the bushes.

The pods are harvested when they turn deep brownish black, and are spread in the sun on mats, sacking or trays. When they have split open the seed is shaken out. Seed should be kept dry during storage.

Flemingia congesta has been propagated by cuttings, but not very successfully. We recommend estates wishing to use this bush cover on a large scale to produce their own seeds as outlined above.

Journal

The *Journal of the Rubber Research Institute of Malaya* is our scientific record of work, prepared for the rubber planting industry of Malaya. In addition to reports of experimental work

carried out under our aegis, the occasional review of work published elsewhere will also appear. Although some attempt is made to prepare each paper in a form which will be as widely acceptable as possible, the intended readership is primarily scientific, and those members of the rub-

ber producing industry who are in a position to assimilate the data presented with a view to its ultimate exploitation.

This year Volume 15 commences in a new format, with a larger page to accommodate tables the more readily. Although it has been decided to maintain the custom of sending one copy gratis to the management of each rubber estate in Malaya on our list, we shall continue to draw attention to the practical significance of the contents to our readers of *Planters' Bulletin*.

After a Foreword by the Director as Editor, appears a review of 'Cover Plants in Rubber Cultivation' by Dr G.A. Watson, who has extensively surveyed the literature, paying particular attention to the cultivation of legumes and to the comparative effects of legumes and non-legumes as covers under hevea.

Comment has already been made in *Planters' Bulletin* 27 (page 112) on the work now written up by Mr D.H. Taysum in the next paper 'Bacterial Culture Media from Hevea Latex'.

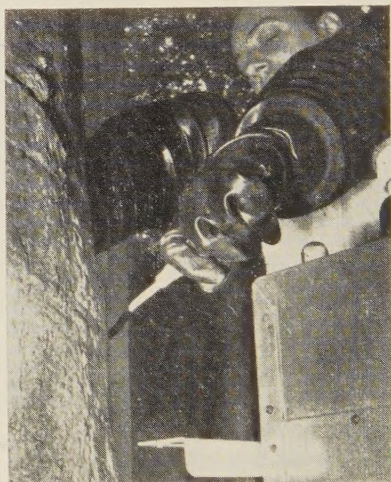
Continuing his account of experiments on deficiency symptoms of hevea, Dr E.W. Bolle-Jones contributes 'A Magnesium-Manganese Interrelationship in the Mineral Nutrition of *Hevea Brasiliensis*'.

Finally the combined results of seventeen long term manuring experiments in Malaya are presented and discussed by Mr G. Owen, Mr D.R. Westgarth and Mr G.C. Iyer in 'Manuring Hevea: Effects of Fertilisers on Growth and Yield of Mature Rubber Trees'; this work is the basis of the advisory article which appeared in our last issue, *Planters' Bulletin* 31.

In all, this issue of our journal is of greater interest than usual to the practical planter.

Microbes in Latex

Several communications by Mr D.H. Taysum of our Chemical Division have been accepted for publication in scientific journals this year. Living organisms are responsible for some of the variation in the properties of hevea latex; numbers and growth rates of bacteria in latex are discussed in a paper submitted to the *Journal of Applied Bacteriology*. A review of the comparative bacteriology of hevea latex and its commercial derivatives will appear in *Applied Microbiology*.



The apparatus devised at Sungei Buloh for collecting latex under aseptic conditions is also described in the *Journal of Applied Bacteriology*; this equipment was demonstrated on our stall at last year's Malayan Agri-Horticultural Association Exhibition and consists of a sealed box denying bacteria access to the tapping panel, which is continuously irradiated with ultra violet light to kill the microbes already present. As the photograph shows, rubber gloves sealed into a window allow for tapping.

R. R. I. Experiment Station

Budwood Available

Budwood of the following clones can be obtained from the Manager, R.R.I. Experiment Station, Sungei Buloh, Selangor. The first mentioned clones are sold subject to an agreement prohibiting resale.

Under Agreement – RRIM '600' series clones and a variety of foreign clones including GT 1, at \$5 per yard f.o.r. Sungei Buloh.

Free Clones – LCB 1320, RRIM 501, 513, 519* and 526 authentic budwood at \$5 per yard f.o.r. Sungei Buloh.

Orders are usually limited to nucleus quantities of each clone, but occasionally larger order can be entertained. It is not our policy to supply individual estates with adequate budwood for large scale field budding.

Proprietary clones such as the Chemara and Prang Besar series must be obtained from the companies concerned.

The R.R.I. Experiment Station do not supply free clones such as Gl 1, PR 107 and Tjir 1 to estates; these clones should be obtained from commercial sources.

* Budwood of RRIM 519 will not be available until July or August 1958.

OUR COVER SHOWS THE
PACKING OF NEWLY CUT
BUDWOOD

